

WINDOW ASSEMBLY HAVING AN OUTER SASH FRAME  
SUPPORTING A REMOVABLE INNER SUB-SASH FRAME BONDED  
TO INSULATED GLASS PANELS

Background of the Invention

**[0001]** In the construction of window and door assemblies, it is common to use insulated glass panel units of the general type disclosed in U.S. Patents No. 5,003,747 and No. 6,675,537 which issued to or are owned by the assignee of the present invention. Usually, the insulated glass units include two parallel spaced rectangular glass panels having peripheral edge portions which receive a rectangular spacer frame. The edge portions and spacer frame are bonded and sealed together by a bonding compound such as a butyl rubber compound or a similar bonding material surrounding the spacer frame. The insulated glass panel unit is assembled into a surrounding rectangular sash frame and is retained by glazing members or beads. Preferably the sash frame and glazing beads are formed from extrusions of plastics material such as polyvinyl chloride (PVC). Such insulated glass panel units are commonly used in fixed window assemblies such as picture windows, single hung windows, sliding windows, bow and bay windows and sliding and swinging patio door assemblies such as disclosed, for example, in U.S. Patent No. 6,318,036 which issued to the assignee of the present invention.

**[0002]** In insulated glass panel units as described above, it is common for the outer edges of the glass panels to be exposed and unprotected during handling and shipping or be covered by a thin layer of the bonding and sealing compound. When the outer edges of the glass panels are relatively unprotected, insulated glass panel units must be carefully handled and carefully protected during shipping. Also, when the edge surfaces of the glass panels are exposed, the personnel handling the insulated glass panel units need to wear gloves in order to avoid cutting their fingers or receiving glass splinters. It is also desirable for a fixed window assembly, such as a picture window assembly, to provide for conveniently removing the insulated glass panel unit in the event of glass breakage or damage or moisture seeps into the space between the glass panels and results in etching the inner surfaces of the glass panels.

Summary of the Invention

**[0003]** The present invention is directed to an improved window assembly having insulated glass panels and which is ideally suited for use in a fixed glass

window unit such as a picture window, a single hung window and sliding and swinging patio doors assemblies. The window assembly of the invention provides for conveniently handling and shipping an insulated glass panel unit while protecting the unit and also provides for conveniently removing the insulated glass panel unit from the surrounding sash frame and from the inside of the window assembly in the event the unit requires repair or replacement. In addition, when the insulated glass panel unit is inserted into the surrounding sash frame, the unit locks to the sash frame so that it is precisely located and is prevented from shifting laterally relative to the sash frame without the use of spacers.

**[0004]** In accordance with one embodiment of the invention, a window assembly constructed in accordance with the invention includes a rectangular outer sash frame formed of sash frame members of extruded rigid plastics material and rigidly connected at the corners of the frame, for example, by miter cuts and welding. The outer sash frame includes a laterally inwardly projecting flange which engages and seals with the outer glass panel of the insulated glass panel unit. A rectangular inner sub-sash frame is formed with sub-sash frame members of extruded rigid plastics material and are also rigidly connected at the corners of the frame such as by miter cuts and welding. The sub-sash frame also includes a laterally inwardly projecting flange which overlaps a peripheral edge portion of one of the glass panels, and the flange is bonded to the glass panel. The sub-sash frame interlocks with the outer sash frame when assembled for precisely locating the sub-sash frame within the surrounding outer sash frame and to limit relative lateral movement. Extruded plastic glazing members have laterally inwardly projecting flange portions which overlap and seal with a peripheral edge portion of the inner glass panel. The glazing members engage a shoulder on an inner wall of the outer sash frame and have spring flange portions which project outwardly between the inner wall and the sub-sash frame and press against the sub-sash frame.

**[0005]** Other features and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

#### Brief Description of the Drawings

**[0006]** FIG. 1 is an elevational view of a fixed window assembly constructed in accordance with the invention;

**[0007]** FIG. 2 is an enlarged vertical section taken generally on the line 2-2 of FIG. 1 and with a center portion broken away;

**[0008]** FIG. 3 is an enlarge horizontal section taken generally on the line 3-3 of FIG. 1 and with a center portion broken away; and

**[0009]** FIG. 4 is a fragmentary section similar to FIG. 3 and showing a modification of a window assembly constructed in accordance with the invention.

#### Description of the Preferred Embodiments

**[0010]** FIG. 1 illustrates a window assembly 10 which includes a rectangular outer sash frame 12 formed by elongated sash frame sections or members 14 and 16 which are extruded of a rigid plastics material such as rigid polyvinyl chloride (PVC). The sash frame members 14 and 16 are rigidly connected at the corners of the frame 12 by mitered cuts and welded corner joints 18. As used herein, the term rectangular with respect to the shape of the frame 12 also includes a square frame. Also, instead of the mitered cuts and welded corner joints 18, the frame sections or members 14 and 16 may be rigidly connected by mechanical fasteners such as screws.

**[0011]** Referring to FIGS. 2 and 3, each of the frame sections or members 14 and 16 are shown with the same cross-sectional configuration, and the outer tubular portion of each sash frame member is shown as substantially rectangular in cross-section. However, it is to be understood that the outer portion of each sash frame section or member may have any desired cross-sectional configuration. As also shown in FIGS. 2 and 3, each of the sash frame members 14 and 16 includes a laterally inwardly projecting flange portion 22 having an inwardly projecting longitudinally extending rib 24 and an inwardly projecting flexible lip seal 26. As generally known in the industry, the flexible lip seals 26 are co-extruded of a PVC material having a lower durometer so that the lip seals are somewhat flexible when compared with the substantially rigid PVC material forming the sash members 14 and 16. Each of the sash frame members 14 and 16 also has an inner wall 28 with an offset or step portion 29 forming a longitudinally extending shoulder 31.

**[0012]** An insulated glass panel unit 35 includes a rectangular inner glass panel 36 and a parallel spaced rectangular outer glass panel 38. In a conventional manner, the glass panels 36 and 38 are spaced parallel by an internal rectangular spacer frame 42 which is commonly formed from a roll formed aluminum sheet metal strip, but may also be formed from another form of spacer material. A bonding compound or material 44, such as a compound

of butyl rubber, surrounds the spacer frame 42 and bonds to the peripheral inner surfaces of the glass panels 36 and 38 to form a sealed air-tight space 46 between the glass panels. The space 46 may be filled with a suitable gas such as argon, and the spacer frame 42 may be used to enclose a desiccant material to absorb any moisture within the space 46.

**[0013]** In accordance with the present invention, a rectangular inner sub-sash frame 50 is enclosed within the outer sash frame 12 and is formed by elongated sub-sash frame members 52 (FIG. 2) and 54 (FIG. 3) which are rigidly connected at the corners of the sub-sash frame, for example, by mitered cuts and welding or by mechanical fasteners such as screws. Each of the sub-sash frame members 52 and 54 are also extruded of a substantially rigid plastics material, such as rigid PVC, and have an outer base portion 56 with inwardly and outwardly facing slots 58 forming generally an H-shaped cross-sectional configuration. Each of the sub-sash frame members 52 and 54 also includes an integrally extruded flange portion 62 which projects laterally inwardly into overlapping relation with a peripheral edge portion of the outer glass panel 38.

**[0014]** The flange portion 62 has an inwardly projecting inner lip 64 which contacts the outer surface of the outer glass panel 38, and a bonding compound or material 66, such as a butyl rubber compound, positively bonds the flange portion 62 to the outer peripheral portion of the glass panel 38. As shown in FIGS. 2 and 3, the base portion 56 of the sub-sash frame members 52 and 54 closely surround the glass panel unit 35 and has substantially the same width in order to cover and protect the outer edges of the glass panels 36 and 38.

**[0015]** In the assembly of the window, the sub-sash frame 50 is placed on a table, and the bonding material 66 is placed on the flange portion 62. The glass panel unit 35 is then lowered into the sub-sash frame 50 until the frame 50 is bonded and sealed to the outer glass panel 38 of the insulated glass panel unit 35. The sub-sash frame 50 and attached glass panel unit 35 are then assembled into the outer sash frame 12 by laying the outer sash frame 12 on the table and then lowering the sub-sash frame 50 and glass panel unit 35 downwardly until the peripherally extending ribs 24 of the outer sash frame flanges 22 are received within the mating grooves 58 of the sub-sash frame members 52 and 54, as shown in FIG. 3. During this assembly, the flexible lip seals 26 engage the outer surface of the outer glass panel 38 and form a fluid-tight seal between the outer sash frame 12 and the glass panel unit 35.

**[0016]** The sub-sash frame 50 and the attached insulated glass unit 35 are retained and secured within the outer sash frame 12 by a set of glazing

sections or members 72 and 74 which are formed from an extrusion of rigid plastics material such as PVC . The glazing members 72 and 74 are not connected but have mitered or abutting corner joints on the inside of the window assembly 10. Each of the glazing members 72 and 74 includes a flange portion 76 which projects laterally inwardly in overlapping relation with a peripheral edge portion of the inner glass panel 36 and has an integrally extruded flexible sealing lip 77 which is formed like the sealing lip 26 and engages the inner surface of the inner glass panel 36 to form a fluid-tight seal. Each of the glazing members 72 and 74 also includes an outer, slightly curved flange portion 81 which is integrally extruded with the inner flange portion 76 and projects outwardly to engage the outer surface of the corresponding sub-sash frame member 52 or 54. The flange portion 81 is slightly flexible and spring-like so that a corner portion of the glazing member is forced laterally outwardly into engagement with the shoulder 31 on the inner wall 28 of the corresponding outer sash frame member 14 or 16. The glazing members 72 and 74 thereby lock the sub-assembly of the sub-sash frame 50 and glass panel unit 35 onto the outer sash frame, as shown in FIGS. 2 and 3.

**[0017]** Referring to FIG. 4 which shows another embodiment of the invention, a window assembly 10' includes an outer sash frame 12 and glazing member 72 and 74 as described above in connection with FIGS. 1-3. In this embodiment, however, a sub-sash frame 50' includes sub-sash frame members 54' and 52' (not shown) which are formed from an extrusion of rigid plastics or PVC material and have base portion 56' with slots 58'. Each of the sub-sash frame members also includes integrally extruded and parallel spaced flanges or wall portions 78 which project laterally inwardly between the glass panels 36 and 38 and are bonded to peripheral edge portions of the glass panels by a suitable bonding material 80 such as a butyl rubber compound. With respect to the construction and attachment of the flanges or wall portions 78 to the inner surfaces of the glass panels 36 and 38, The disclosures of U.S. Patent No. 6,286,288 and No. 6,536,182, which are owned by SashLite, LLC, are herein incorporated by reference.

**[0018]** From the drawings and the above description, it is apparent that a window assembly constructed in accordance with the present invention, provides desirable features and advantages. For example, after the sash frame 12, sub-sash frame 50 and glass panel unit 35 are assembled, as shown in FIGS. 2 and 3, moisture from the outside is prevented from seeping into the space 46 between the glass panels 36 and 38 by not only the lip seal 26 and

bonding compound 66, but also the bonding compound 44 surrounding the spacer frame 42. It is also apparent that when the sub-sash frame 50 is attached to the glass panel unit 35, the frame 50 provides for not only protecting the outer edge portions of the glass panels 36 and 38, but also for conveniently handling and transporting the glass panel unit 35 after it is assembled and until it is lowered into the outer sash frame 12.

**[0019]** The assembly of the sub-sash frame 50 and attached glass panel unit 35 may also be conveniently removed from inside the building after the outer sash frame 12 has been installed simply by using a sharp blade and prying laterally inwardly on the glazing members 72 and 74 against the bias of the spring flanges 81 until the glazing members are released from the shoulders 31 on the outer sash frame 12. Such convenient removal of the glass panel unit 35 with the sub-sash frame 50 is occasionally desirable from inside the building, for example, when a glass panel 36 or 38 has been damaged or broken. It is also apparent from FIGS. 2 and 3 that the interfitting connection of the outer sash frame 12 and the sub-sash frame 50, by means of the peripherally extending rib 24 within one of the peripherally extending grooves 58, effectively eliminates or limits any lateral movement of the sub-sash frame 50 and glass panel unit 35 relative to the outer sash frame 12. The modification shown in FIG. 4 also provides all of the above advantages in addition to eliminating the spacer frame 42 and surrounding bonding material 44.

**[0020]** While the forms of window assembly and the methods of assembly herein described constitute preferred embodiments of the invention, it is to be understood that the invention is not limited to the precise methods and forms of assembly described, and that changes may be made therein without departing from the scope and spirit of the invention as defined in the appended claims.

What is claimed is: